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COMPLETE SPECIFICATION.

Improvements in or relating to Electrical Apparatus for Separating Oil from Aqueous Liquids.

We, HOLFORD PROCESSES LIMITED, a British Company, of 48 Cannon Street, London, E.C.4, and HASTINGS JOHN HOLFORD, a British Subject, of 4a Benggo Street, Hertford, Hertfordshire, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to apparatus for separating oil from aqueous liquids and of the kind comprising a vessel in which are situated spaced baffles, means for introducing the mixture of oil and aqueous liquid between electrodes, means for withdrawing the separated oil from the upper part of the vessel, and means for withdrawing the liquid from the lower part of the vessel. An example of such apparatus is described in Patent Specification No. 702,986 to which apparatus this invention is particularly applicable.

The term "oil" used throughout the Specification is intended to include mineral, animal and vegetable oils and fats and greases and the apparatus is used for dehydrating or clarifying such aqueous mixtures.

According to this invention an apparatus of the kind referred to above for separating oil from aqueous liquid is characterised in that means are provided for promoting a flow of the mixture through said vessel so as to maintain it full under pressure and in that the rate of flow of mixture is controlled by means responsive to changes in level of the dividing line between the separated oil and aqueous liquid, whereby the depth of separated oil above the aqueous liquid is maintained substantially constant.

A suitable potential to employ is from 600 volts to 10,000 volts. The source of supply is preferably a D.C. supply. It is found that by maintaining the vessel full and under pressure the separation of the oil from the aqueous liquid is greatly enhanced. The rate of flow of liquid through the vessel may be controlled by an electro-magnetically operated valve in an outlet conduit communicating with the bottom of the vessel which electro-magnetically operated valve is in circuit with a source of electric supply through two contacts, one of which is disposed in the vessel at a location corresponding to the required position of the dividing line between the separated oil and the liquid, the other of which contacts may comprise any part of the apparatus which is at all times in contact with the aqueous liquid, which valve is arranged to close as soon as both contacts are covered by the aqueous liquid, and do not open again until the required depth of oil at the top of the vessel is obtained. It will be appreciated that since oil is a non-conductor or bad conductor, the electro-magnetically operated valve will not be energised so long as a contact is immersed in the oil.

One or more contacts may be arranged in the upper part of the vessel at different levels, which contacts may be cut into and out of circuit with the source of supply and electro-magnetically controlled valve by suitable switch gear whereby the depth of the separated oil in the vessel may be varied.

The required pressure head may be obtained by arranging an outlet conduit to extend from the lower end of the vessel to a delivery point at an appropriate distance above the vessel.

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A filter unit may be arranged in a by-pass passage connected to the outlet conduit, and controlled by suitable valves, which filter unit removes any traces of oil which may remain in the separated aqueous liquid.

The filtering medium may comprise bauxite, Fullers Earth, and other proprietary absorbent materials, desintegrated coke and the like and may be in the form of a cartridge which can be readily removed from the filter unit when exhausted, and replaced by a fresh cartridge.

The rate of flow of liquid through the vessel may be controlled by means responsive to changes in level of the dividing line between the separated oil and aqueous liquid whereby the depth of separated oil above the aqueous liquid is maintained substantially constant.

A control valve may be arranged in the outlet conduit whereby the pressure within the vessel may be varied, this control valve may be disposed in that part of the outlet conduit which is bridged by the by-pass passage containing the filter unit.

The aforesaid electrodes may comprise superimposed plates spaced apart in the lower end of the vessel, and extending over the greater part of the cross sectional area of the vessel and a perforated supply conduit may be arranged to extend upwardly through the lower plate which is so shaped as to direct upwardly the streams issuing from the perforations in the supply conduit. For example, the lower electrode may be shaped to provide an inverted conical wall surrounding the perforated supply conduit and an outwardly directed flange at the upper end of the cone.

The upper electrode may be conical in shape and may be provided with a number of perforations. Means may be provided for adjusting the distance apart of the two electrodes. For example, the upper electrode may be secured to a rod extending through a gland in a cover plate at the top of the vessel and may be provided on the outside of the cover plate with suitable elevating gear, which rod is connected to a source of electric supply. A supply cable may extend through a suitable insulator attached to the cover plate and connected to said rod. The insulator may comprise a sealed chamber containing oil.

Instead of connecting the lead to the rod supporting the upper electrode, a separate cable may extend into the interior of the vessel, and be connected to the electrode, which cable is arranged to extend through an insulator or connected to a conductor which extends through an insulator carried by a wall of the vessel.

The following is a description of one form of oil separator according to the invention, reference being made to the accompanying drawing which is a diagrammatic cross section through the apparatus. The apparatus comprises a cylindrical vessel 10. Extending through the wall of this vessel near the bottom thereof is a supply pipe 11 for the mixture from which the oil is to be separated, which supply pipe is controlled by a cock 12. The mixture is fed under pressure through the supply pipe by a pump (not shown). The cylindrical vessel is closed top and bottom by suitable plates 13, 14. The supply pipe is provided with an upwardly extending perforated distributing nozzle 15, which is encircled by an inverted conical member 16, having a downwardly and outwardly extending flange 17 at its upper extremity, which leaves a gap 18 between its outer circumference and the inner surface of the cylindrical vessel 10. The flange 17 constitutes a baffle and is arranged to operate as a cathode connected in a high potential electric circuit through the supply pipe 11 and vessel 10. Disposed above the cathode 17 is a conical sheet metal baffle 19 constituting an anode which may rest on insulating blocks 48 carried by brackets 49 on the casing 10. The baffle is formed with a number of apertures 20 around its lower extremity, which baffle is secured to a rod 21 which extends upwardly through an electrically insulating gland 22 in the plate 13. The rod 21 may be guided by an electrically insulating bearing 23 carried by a spider 24 fixed within the cylindrical casing 10. Either the rod 21 may be connected to a cable 25 through a lead-in insulator 26, or a cable 25 may be connected to a conductor 27 which extends through an insulator 28 carried by the plate 13, and is attached directly at its lower extremity to the baffle 19. Means (not shown) may be provided for adjusting the distance apart of the cathode 17 and anode 19. Thus in the case where a separate conductor 27 extends to the anode the rod 21 extends through an insulating gland and is provided with a rack on its projecting end which is engaged by a pinion. Alternatively the anode may be suspended by an electric cable which passes through the gland and over a pulley and is attached to the drum or winch arranged near the bottom of the apparatus.

The lower part of the cylindrical vessel 10 is provided with an effluent outlet conduit 29 leading to a static pipe 30 through an electro-magnetically controlled valve device 31. The static pipe 30 extends above the top of the cylindrical vessel so that the liquid within the vessel is under pressure. The static pipe contains a sight glass 32. An effluent filter chamber 33 is connected at its upper and lower ends to the vessel by branch pipes 34 and 35 to form a by-pass. The two branch pipes

contain control cocks 36 and 37 respectively. By viewing the liquid passing the sight glass, it can be determined whether the final traces of oil have been removed and also whether the filtering medium requires to be replenished. The filtering chamber 33 is provided with a removable lid 47 and the filtering medium is in the form of a cartridge which may be introduced or drawn from the chamber after the removal of said lid.

The rate of flow of the mixture through the cylindrical vessel is controlled by the aforesaid electro-magnetically operated valve 31, which is connected to one side of a source of electric supply through one or other of two contacts 38 and 39, an electric switch 41 being provided in the conductor 50 between the two contacts and another switch 51 between the lower contact 39 and the conductor which switches may be interconnected so that when one is open the other is closed and vice versa. The other side of the electric source of supply being connected to the vessel 10. The two contacts 38 and 39 are disposed at different levels in the vessel at locations corresponding to the required position of the dividing line between the separated oil and the liquid. The valve is arranged to close as soon as one or other of the contacts is covered by the aqueous liquid according to the setting of the switches and does not open again until the required depth of oil at the top of the vessel is obtained. Thus, as long as the selected contact is immersed the electro-magnetic valve will be energised. One or more deflector plates or baffles may be disposed in the upper part of the cylindrical vessel shortly below the lower of the two contacts 39, one of which 42 is shown in the drawing.

An outlet pipe 43 communicates through a valve chamber 44 with the upper end of the cylindrical vessel, which valve chamber embodies a float valve 45, the float 46 of which is arranged to float on the separated oil at the top of the liquid column within the vessel and operates the valve through a suitable transmission 52. An immersion heater 47 is arranged within the oil space so as to maintain the oil in the required fluid state.

Alternatively or additionally steam heated coils 71 and 72 may be arranged both in the upper and lower parts of the vessel, the steam being fed into the upper coils and discharged from the lower coils into a steam trap 73. The upper coil may have a greater number of convolutions than the lower coil. Such an arrangement is particularly suitable for treating aqueous mixtures containing fats and greases.

The vessel may also be provided with a suitable pressure gauge and thermometer.

What we claim is :—

1. An apparatus of the kind referred to for separating oil from aqueous liquid wherein means are provided for promoting a flow of the mixture through said vessel so as to maintain it full under pressure and wherein the rate of flow of mixture is controlled by means responsive to changes in level of the dividing line between the separated oil and aqueous liquid, whereby the depth of separated oil above the aqueous liquid is maintained substantially constant.

2. An apparatus according to Claim 1, wherein the rate of flow of liquid through the vessel is controlled by an electro-magnetically operated valve in the outlet conduit communicating with the bottom of the vessel, which electro-magnetically operated valve is connected with a source of electric supply through two contacts, one of which is disposed in the vessel at a location corresponding to the required position of the dividing line between the separated oil and the liquid, and the other of which contacts comprises any part of the apparatus which is at all times in contact with the aqueous liquid, which valve is arranged to close as soon as both contacts are covered by the aqueous liquid and does not open until the required depth of oil at the top of the vessel immerses the first said contact.

3. An apparatus according to Claim 2, wherein one or more contacts is or are arranged in the upper part of the vessel in different levels, and wherein suitable switch gear is provided for cutting in or out said contacts with the source of supply by the depth of separated oil in the vessel which may be varied.

4. An apparatus according to any of the preceding claims, wherein the required pressure head is obtained by means of an outlet conduit extending from the lower end of the vessel to a delivery point above the vessel.

5. An apparatus according to any of the preceding claims, wherein a filter unit is arranged in a by-pass passage connected to the outlet conduit and controlled by one or more valves.

6. An apparatus according to Claim 5, wherein the filtering medium for the filter unit comprises Fullers Earth, and other proprietary absorbent materials, or dis-integrated coke.

7. An apparatus according to Claim 5 or Claim 6, wherein the filtering medium is in the form of a cartridge and said unit is constructed so as to permit the cartridge to be readily inserted or removed.

8. An apparatus according to any of the preceding claims, wherein a manually-

operated control valve is arranged in the outlet conduit.

9. An apparatus according to Claim 8, wherein the manually operated control valve is disposed in that part of the outlet conduit which is bridged by the by-pass passage containing the filter unit.

10. An apparatus according to any of the preceding claims, and having electrodes arranged in said vessel to produce a high tension field, for assisting in the separation of the oil, which electrodes comprise superimposed plates spaced apart at the lower end of the vessel and extending over the greater part of the cross sectional area thereof, and wherein a perforated supply conduit extends upwardly through a lower plate which is so shaped to direct upwardly the streams issuing from the perforation of the supply conduit.

11. An apparatus according to Claim 10, wherein the lower electrode is shaped to provide an inverted conical wall surrounding the perforated pipe and an outwardly directed flange at the open end of the cone.

12. An apparatus according to Claim 9 or Claim 10 wherein the upper electrode is conical in shape and is provided with a number of perforations.

13. An apparatus according to any of Claims 10 to 12 wherein means are provided for adjusting the distance apart of the two electrodes.

14. An apparatus according to any of the preceding claims, wherein an oil outlet at the top of the vessel is provided with a float-controlled valve, the float of which is disposed in the oil space within the vessel.

15. An apparatus according to Claim 14, wherein a heater is disposed in the upper part of the vessel.

16. An apparatus according to Claim 5 or any claim appendent to Claim 5, wherein a sight glass is arranged in said outlet above the filter unit.

17. An apparatus for separating oil from aqueous liquid substantially as described with reference to the accompanying drawing.

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PROVISIONAL SPECIFICATION.

Improvements in or relating to Electrical Apparatus for Separating Oil from Aqueous Liquids.

We, HOLFORD PROCESSES LIMITED, a British Company, of 48 Cannon Street, London, E.C.4, and HASTINGS JOHN HOLFORD, a British Subject, of 4A Bengeo Street, Hertford, Hertfordshire, do hereby declare this invention to be described in the following statement :—

This invention relates to apparatus for separating oil from aqueous liquids and of the kind comprising a vessel in which are situated spaced electrodes between which is applied an electrical potential difference, means for passing the mixture of oil and aqueous liquid between the electrodes, means for withdrawing the separated oil from the upper part of the vessel, and means for withdrawing the liquid from the lower part of the vessel. Examples of such apparatus are described in Specifications of Applications Nos. 9411/50 and 23174/52 to which apparatus this invention is particularly applicable.

According to the invention an apparatus of the kind referred to above for separating oil from aqueous liquid is characterised in that means are provided for maintaining said vessel full of liquid under pressure. The pressure may be up to 8 feet of water or more.

A suitable potential to employ is from 600 volts to 10,000 volts. The source of supply is preferably a D.C. supply. It is found that by maintaining the vessel full and under pressure the separation of the oil from the aqueous liquid is greatly enhanced. The required head may be obtained by arranging an outlet conduit to extend from the lower end of the vessel to a delivery point above the vessel.

A filter unit may be arranged in a by-pass passage connected to the outlet conduit, and controlled by suitable valves, which filter unit removes any traces of oil which may remain in the separated aqueous liquid.

The filtering medium may comprise bauxite and may be in the form of a cartridge which can be readily removed from the filter unit when exhausted, and replaced by a fresh cartridge.

The rate of flow of liquid through the vessel may be controlled by means responsive to changes in level of the dividing line between the separated oil and aqueous liquid whereby the depth of separated oil above the aqueous liquid is maintained substantially constant.

The rate of flow of liquid through the vessel may be controlled by an electromagnetically operated valve in an outlet

conduit communicating with the bottom of the vessel which electro-magnetically operated valve is in circuit with a source of electric supply through two contacts, one of which is disposed in the vessel at a distance corresponding to the required position of the dividing line between the separated oil and the liquid, the other of which contacts may comprise any part of the apparatus which is at all times in contact with the aqueous liquid, which valve is arranged to close as soon as both contacts are covered by the aqueous liquid, and do not open again until the required depth of oil at the top of the vessel is obtained. It will be appreciated that since oil is a non-conductor or bad conductor, the electro-magnetically operated valve will not be energised so long as that contact is immersed in the oil.

One or more contacts may be arranged in the upper part of the vessel at different levels, which contacts may be cut into and out of circuit with the source of supply and electro-magnetically controlled valve by suitable switch gear whereby the depth of the separated oil in the vessel may be varied.

A control valve may be arranged in the outlet conduit whereby the pressure within the vessel may be varied, this control valve may be disposed in that part of the outlet conduit which is bridged by the by-pass passage containing the filter unit.

The aforesaid electrodes may comprise superimposed plates spaced apart in the lower end of the vessel and extending over the greater part of the cross sectional area of the vessel and a perforated supply conduit may be arranged to extend upwardly through the lower plate which is so shaped as to direct upwardly the streams issuing from the perforations in the supply conduit. For example, the lower electrode may be shaped to provide an inverted conical wall surrounding the perforated supply circuit, and an outwardly directed flange at the upper end of the cone.

The upper electrode may be conical in shape and may be provided with a number of perforations. Means may be provided for adjusting the distance apart of the two electrodes. For example, the upper electrode may be secured to a rod extending through a gland in a cover plate at the top of the vessel and may be provided on the outside of the cover plate with suitable elevating gear, which rod is connected to a source of electric supply. A supply cable may extend through a suitable insulator attached to the cover plate and connected to said rod. The insulator may comprise a sealed chamber containing oil.

Instead of connecting the lead to the rod supporting the upper electrode, a separate cable may extend into the interior of the vessel, and be connected to the electrode, which cable is arranged to extend through an insulator or connected to a conductor which extends through an insulator carried by a wall of the vessel.

An apertured deflector plate may be disposed in the upper part of the vessel a short distance below the contact in circuit with the electro-magnetically operated valve.

An outlet for the oil is provided at the upper end of said vessel for example, is connected to the cover plate through a suitable control valve. The control valve may either be arranged to open at a predetermined pressure of the oil within the vessel or at a predetermined depth of oil in the upper part of the vessel. In the latter case a float may be guided to move in an up and down direction by a cradle attached to the cover plate at the top of the vessel and is connected by a lever link mechanism to a valve controlling that outlet from the vessel.

An immersion heater may be disposed in the upper part of the vessel at such a level as to be immersed in the separated oil, for example, it may be disposed above the upper contact which controls the aforesaid electro-magnetically operated valve in the discharge conduit. The immersion heater may be controlled by the thermostat, the heat responsive element of which is disposed in the oil.

A sight glass may be provided in the outlet conduit above the by-pass, containing the filter so as to ensure that the final traces of oil have been removed, and also for determining when the filtering medium requires to be replenished.

The vessel may be provided with a suitable pressure gauge and thermometer.

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COMPLETE SPECIFICATION

This drawing is a reproduction of the Original on a reduced scale